DOCUMENT RESUME

ED 182 806 EA 012 378

TITLE The Fourth R. Resourcefulness in School Energy Conservation. SEED: Schoolhouse Energy Efficiency Demonstration.
INSTITUTION Tenneco, Inc., Houston, Tex.
PUB DATE Oct 79
NOTE 25p.: For a related document, see EA 012 379

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Air Conditioning: Building Improvement: *Efficiency: Elementary Secondary Education: *Energy: *Energy Conservation: Equipment Maintenance: Heating: Lighting: *Management: Pamphlets
IDENTIFIERS *Energy Audits

ABSTRACT

An energy audit is a building inspection that, when complete, provides a profile of the building's energy usage. The energy audit determines how energy is used: simple maintenance and operating procedures to conserve energy: and the need, if any, for purchase of new energy saving equipment or modifications to the building. Schoolhouse Energy Efficiency Demonstration (SEED) was initiated in response to the pressing need, in the face of rising energy costs, for schools to use energy wisely. Twenty demonstration schools in the 15 states were selected for the program because of similarity to other structures in the surrounding area. This pamphlet presents some of the common problems discovered in the audits. These problems provide examples of low-cost, quick-fix opportunities for energy conservation. Some of these items apply to homes and other structures as well. (Author/MLF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

G. GRAVLEY

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

The Fourth R

Resourcefulness in School Energy Conservation

ED182806

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

EA 012 378

SEED

A Public Service Program
Sponsored by

Tenneco Inc
Public Affairs Department
P.O. Box 2511
Houston, Texas 77001

The following school and education-related organizations encourage and recommend the SEED (Schoolhouse Energy Efficiency Demonstration) Program, sponsored and developed by Tenneco Inc., Houston, Texas:

American Association of School Administrators
Association of School Business Officials
Council for American Private Education
Education Commission of the States
National Association of Elementary School Principals
National Association of Secondary School Principals
National Congress of Parents and Teachers (PTA)
National Education Association
National School Boards Association

CONTENTS

Introduction III
The Twin Problems of Energy Facing Schools 1
  Rising Energy Costs: A Vicious Circle 2
  Inefficient Use of Energy 4
The Solution 5
  Energy Management 6
The Audit 9
  The SEED Audit 10
Findings 11
  Energy-Saving Opportunities 12
  People 19
  Conclusion 20
The Next Step 21

"A school is more than a building—much more than wood, bricks and mortar, a school is people working together for the common benefit of children.

It is parents and teachers working side-by-side to provide the best possible education for our children. This cooperative effort helps to form a positive, happy, warm atmosphere in the school; this becomes its personality."

Bob Landis, Principal
Lynnewood Elementary
Havertown, Pennsylvania

4/5

INTRODUCTION

Energy management, although it has an engineering ring, is an education issue that directly affects the classroom.

Why? Because the higher cost of energy can mean less money for education programs.

Schools throughout the country are responding to the higher cost of energy by becoming more efficient in the ways they use energy.

School patrons, PTA leaders and others can assist their schools in conserving energy.

There can be a big payoff:

The typical American school can reduce its energy consumption by one third.

Energy for education, kindergarten through high school, costs more than $3 billion a year, and an estimated $1 billion of that at today's prices can be saved.

On the local level, most schools are hard-pressed financially, and could benefit immediately from energy conservation efforts.

Best of all, much in energy conservation can be achieved out of the operating budget, using school maintenance people.

An excellent introduction to the need for energy management in schools is provided through a new film, The Fourth R, starring Eve Arden. This is a 21-minute non-commercial, public service film produced by Tenneco Inc. and endorsed by the American Association of School Administrators.

THE TWIN PROBLEMS OF ENERGY FACING SCHOOLS

The schools have great difficulty increasing tax rates. They certainly can't cut back the quality or the quantity of the product.

Other types of structures in this country were built over a long period of time, but more than half our schools were put up in one short building boom, from 1955 to 1965.

One boom grew from another: the post-war "baby-boom." Space was critical, energy was cheap and plentiful, so operating costs received little attention. Today, those baby-boom schools are energy sieves. The challenge is to make them efficient users of energy.

7

RISING ENERGY COSTS: A VICIOUS CIRCLE

There are two problems related to energy consumption facing our schools. One is the rising cost of energy and the other is the inefficient use of energy.

In the typical school budget, 85 percent is allocated to salaries and benefits and the remaining 15 percent (called discretionary) to books, athletics, special programs and utility bills.

Since 1973, energy costs have grown from $20 per pupil per year to almost $60 per pupil. And, the price continues to climb.

Rising fuel costs pose a special problem because schools operate on fixed incomes. They cannot recover cost increases by adding to the cost of their goods or services. They either have to cut education programs, ask the state legislature for more money or appeal to voters for higher taxes. It is extremely difficult to persuade the voter to choose to pay higher taxes. If schools are forced to absorb the extra cost, they must cut spending in other areas. Some school administrators have been forced to make such difficult decisions as eliminating art or music programs, cutting back physical education and reducing capital expenditures.

These remarks of a New Jersey school administrator echo the frustrations facing many schools today:

"Not only does fuel cost us more, we're using more than we should be—we're wasting the resources of the future—because we don't have the dollars we need to go in and improve our buildings and our heating systems and controls. It's a vicious circle. Until we get the money from outside to improve our physical plant and cut down on the waste of fuel, we're going to have to struggle, while the money we need for education goes up the chimney."

INEFFICIENT USE OF ENERGY

Inefficient use of energy only compounds the problems of rising energy costs. Not only does fuel cost more, but schools consume energy needlessly. During the 1977-1978 academic year, the energy bill for the nation's education facilities was more than $3 billion. A one-third cut in energy consumption by schools would mean $1 billion more for education at today's prices.

Those schools constructed in the 1950's and 1960's were built to house as many as possible, as quickly as possible, for as little money as possible. The architectural influence during that period emphasized single level buildings with lots of glass. From today's perspective of energy consciousness, the school building boom took place at the worst possible time. Energy efficient building designs and materials are now available but very few schools are under construction. School administrators must use existing structures for many years to come. The key is to make existing buildings more energy efficient with limited capital investments.

THE SOLUTION

The American economy is becoming more energy efficient:

• New structures, from skyscrapers to homes and warehouses, are employing the latest designs and equipment to make the best use of energy.

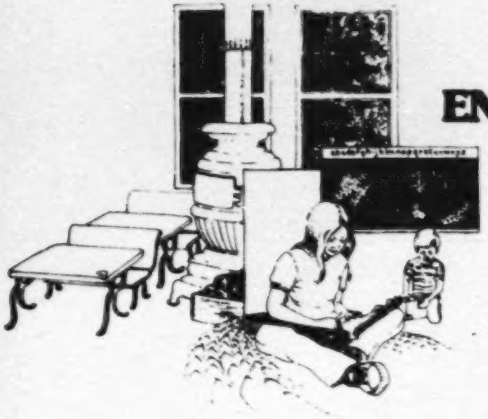
• New cars are providing comfort, convenience and mobility at greatly improved gasoline mileage.

• American industry is spending millions of dollars to make its plants and factories as efficient as any in the world.

Schools are on the same track.

Dr. Shirley J. Hansen, director of energy programs for the American Association of School Administrators, works with school energy managers. She states, "A lot can be done. A lot is being done."

11



ENERGY MANAGEMENT

More and more, energy management has become an accepted concept for school administrators concerned with stretching education dollars. In the days of the one-room schoolhouse, energy management was the simple task of assigning one of the children to carry in the firewood and refill the kerosene lantern.

Much has happened on the way from the Franklin stove to the all-electric kitchen, but we do have something in common with that self-reliant generation of a century ago. We, too, are beginning to rediscover and understand the importance of teamwork, thrift and resourcefulness.

A school energy management program requires the commitment and cooperation of the school board, administrators, principals, teachers, custodians, parents and students. One of the most effective school energy management programs, formed around this concept of cooperation and teamwork, is the Total Education Energy Management (TEEM) program developed by the Colorado Department of Education.

TEEM recommends a step-by-step strategy for developing energy management programs:

- A Board of Education policy.
- A district-wide conservation committee.

- Specific responsibilities.
- Energy usage guidelines and monitoring procedures.
- Good records.
- Evaluations.

The strength of the TEEM program is that it involves all segments of the education community. The cooperation and teamwork which programs such as this provide generate the motivation that school communities need to accomplish common goals.

Other kinds of motivation exist as well. Some states and school districts provide monetary incentives to schools for energy conservation. For example, some school districts will return a portion of the money not spent for energy to the school for special programs. This, too, is teamwork. In addition, the Federal Government through the Department of Energy will provide 50/50 matching funds to schools for energy audits and the modifying of buildings.

Similar to a financial audit or a complete physical examination, an energy audit is an inspection of a building which, when complete, provides a profile of the building's energy usage.

The energy audit determines:

- How energy is used.
- Simple maintenance and operating procedures to conserve energy.

13

• The need, if any, for purchase of new energy saving equipment or modifications to the building.

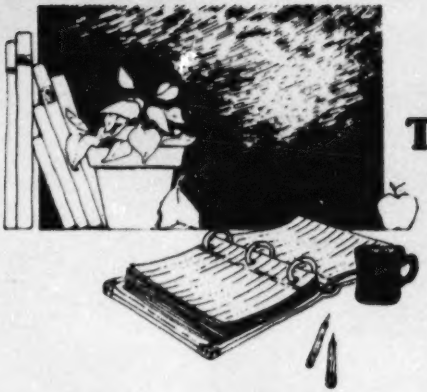
This is where the Schoolhouse Energy Efficiency Demonstration (SEED) and other energy conservation programs come in. Energy audits help schools learn how they use energy, and recommend low-cost, quick-fix improvements which result in energy savings.

THE AUDIT

After the Board of Education and the Superintendent make the policy decision to launch an energy management program, the first step is the energy audit.

It describes the strong points, analyzes problems and points to solutions.

But the energy audit by itself doesn't save a drop of energy. If it goes into a desk drawer, it's worthless. If people use it to take action, it has great value.



THE SEED AUDIT

Schoolhouse Energy Efficiency Demonstration (SEED) was initiated in response to the pressing need for schools to use energy wisely in order to prevent the erosion of the education dollar caused by rising energy costs. Twenty demonstration schools were selected because of similarity to other structures in the surrounding area. Consultants inspected the schools, looking for inexpensive and easy ways to save energy and money.

The process itself is simple and consists of the following:

- Preliminary on-site investigation and data-gathering.
- Careful analysis of the preliminary data.
- A two-day complete examination of the school.
- A written report of findings, including recommendations for energy savings.

Although the audit process is simple and the resulting recommendations may seem obvious, the analysis is complex. Much time and energy, and some money, is required to perform a good audit and to develop an appropriate energy management program. However, schools will find that the investment required will be well worth the effort in terms of energy and money saved.

FINDINGS

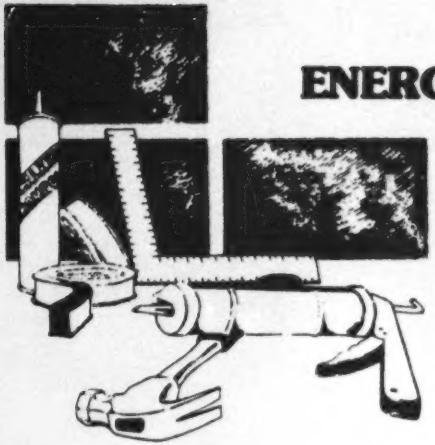
• The typical American school can cut its energy consumption by one third.

• This can be achieved through low-cost modifications that are easy to do and that pay for themselves quickly, often in less than a year.

• Many of these fixes can be done by maintenance people and paid for out of the operating budget.

• The smallest expenditures often produce the biggest saving.

17



ENERGY-SAVING OPPORTUNITIES

When implementing an energy conservation program, it's essential to regard the building as a unit—a complex, integrated system of heating, cooling and lighting. When first built, the system was designed to be in balance—everything was working as intended. Energy conservation begins with restoration of the original balance. After that, careful examination of the system may produce additional energy savings.

A complete report on the 20 energy audits conducted during the SEED program is available to persons engaged in energy management. In this chapter, some common problems are presented, to serve as examples of low-cost, quick-fix opportunties for energy conservation. Some of these items apply to homes and other structures as well.

The Heating System

The typical school is heated by steam or hot water produced by boilers and forced through pipes. Each room has a by-pass valve which allows heat to pass the room if unneeded. This valve is controlled by the thermostat.

Typical problems and opportunities:

• Some by-pass valves will not be working properly, causing classrooms to be overheated. Often, faulty valves can be repaired at low cost.

• Some thermostats will not be set correctly, giving faulty signals to the heating system. Thermostats should be calibrated annually.

In many schools, each classroom has a unit ventilator, which blows heated air into the room. In addition, the unit ventilator brings in fresh air from the outside—cold fresh air that has to be heated. The amount of cold fresh air entering the room is controlled by a damper in the unit ventilator.

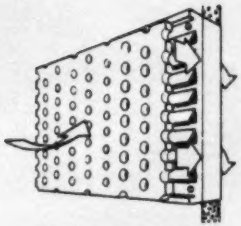
Typical problems and opportunities:

• Far too much cold outside air may be entering the classroom, boosting the heating bill. The damper should restrict the flow of outside air to the minimum permitted by state code.

• Some state codes on ventilation were written years ago. Many codes have recently reduced outside air requirements, but many unit ventilators have not been adjusted accordingly.

• Even when the damper is set correctly, a 10-mile-an-hour wind will force as much as three times the desired amount of cold, fresh air into the room. Pegboard, commonly used for hanging tools in a workroom, can shut out the wind. This solution was developed by the Livonia, Michigan, Public Schools. (See illustration)

Most schools have roof-top fans which expel stale air from the building. The air being expelled is heated air, which must be replaced by cold outside air brought in through the unit ventilators.



Pegboard on outside of unit ventilator

Typical problems and solutions:

• The fans may run continuously, expelling heat needlessly. Timers on the exhaust fans will shut them on and off automatically as required.

• Ventilation shafts from the classroom to the roof may not have dampers, and be open to the sky. Suction in the shafts causes heat to flow out of the building, and wind increases loss due to this chimney effect. Dampers can be installed at the roof level that will open when the fan turns on, and close when the fan shuts off.

• A school may have more fans than required. Heat can be saved by disconnecting the unneeded fans.

Modern sprawling schools may have a dozen or more doors and hundreds of windows.

Typical problems and opportunities:

• Doors may not fit tightly, and cracks may exist around windows. Many small heat leaks add up to a serious problem. Often, weatherstripping and caulking may not be expensive and can be very cost-effective.

• Heat is conducted through glass like electricity over a wire. To cut down on excessive heat loss by transmission through glass, window insulation can be installed.

Schools are often built with several wings, each with a long corridor with classrooms to either side. There may be an outside door at one end

of the corridor, or even both ends. And the classroom thermostat often is located just inside the door to the corridor.

Typical problems and opportunities:

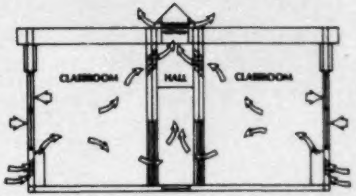
• The corridor usually is cooler than the classroom, because of the constant opening of doors to the outside. Changes in traffic patterns can restrict use of some outside doors, cutting down on wind tunnel effect in corridors.

• Classroom doors are often left open, allowing cold air from the corridor to activate the classrooms thermostat even when the classroom is warm. This causes the thermostat to send a faulty signal, bringing on unneeded heat. To offset the added heat, windows may be opened even on cold days. Classroom doors and windows should be closed during the heating season.

This all adds up to one big problem: drafts. (See illustration)

In addition to putting an unnecessary load on the furnace, these currents of air cause people to feel cold even when the temperature reading says they should feel warm.

Again, the school has to be seen as a unit. A planned effort to reduce exhaust, reduce fresh air intake, close doors and windows and plug up leaks can reduce drafts. At that point, a lower thermostat setting may be comfortable as well.



Drafts

The source of the school's heat, the boiler, is equally important. A major concern is efficiency. If a boiler tests out at 80 per cent efficient, it means that 80 per cent of the fuel burned is converted to heat that enters the building, and 20 per cent of the heat goes up the chimney. A second issue is the number of hours the boiler is operated.

Typical problems and opportunities:

• A good boiler often will test at 80 per cent efficient. An increase in efficiency of one percentage point at a typical school in the Middle West can mean an annual saving of $250.

• Night setback remains the single biggest opportunity for energy saving in most schools, and homes and other buildings as well. Night temperatures can be lowered a notch at a time until the lowest possible setting is reached, considering morning warm-up time and protection of equipment. A point to remember: because of weekends, nights and holidays, a school is closed 3½ hours for each one hour it is in operation. Therefore, reducing the temperature one degree at night saves as much fuel as reducing the temperature 3½ degrees during school hours.

Landscaping also can make a difference. Deciduous trees provide cooling shade during the air conditioning season, and after the leaves have fallen permit the sun to help warm the building. Trees also act as a windbreak, an asset in winter.

The Lighting System

Lighting uses less energy than heating, but the typical school can achieve substantial savings in its lighting costs.

Typical problems and opportunities:

- The light level may exceed the state code. Schools find a light meter to be a wise investment, for determining which lights can be turned off.
- Many schools still use incandescent lamps, which provide low-quality light at high cost. Standard fluorescent lamps can be as much as 400 per cent more efficient than incandescent lamps. The new high-efficiency fluorescent lamps can be as much as 14 per cent more efficient than the standard fluorescent.
- Many classrooms have three banks of fluorescent lamps, each bank controlled by a separate light switch. On bright days, the bank of lamps near the window can be turned off.
- Some schools have used dark colors on walls and floors. At normal repainting time, light colors can be used to increase reflectivity.

Air Conditioning

About eight per cent of schools have central air conditioning and many others have window units. Three recommendations made for savings in lighting and heating also can reduce air conditioning costs:

- Because artificial lighting produces heat, the use of natural lighting

can reduce the load on the cooling system.

- Use of window insulation also helps keep out heat.
- Caulking and weatherstripping that plug heat leaks in winter also prevent heat gain in hot weather.

In addition, careful scheduling can reduce the amount of time cooling is required. In the summer, when only the school's office is in use, the cooling system should be modified so that empty classrooms are not cooled as well.

Other Opportunities

Equipment in the school—for heating or cooling the building, heating water, cooking meals and so on—eventually wears out and has to be replaced. At normal replacement time, many schools specify high energy efficiency ratings in their bid requests.

When all the equipment is in perfect operating condition, it's up to people to make sure the system functions correctly. Some schools have an Energy Alert Card in each classroom, giving the correct thermostat setting, reminders for use of lights and window shades, and the name and telephone number of maintenance people.

PEOPLE

An important and essential element to energy management is people—all kinds of people, from the school board to the custodian, from the children to their parents. Everyone has an important role to play.

School board members can set the tone in their community by speaking out for energy conservation and encouraging school administrators to establish sound energy management programs.

Superintendents can establish district wide energy management programs and provide principals with the incentive necessary to implement them.

Principals, responsible for the day-to-day operation of the individual school, play a pivotal role in energy management. Their commitment to energy conservation defines the success or failure of the energy conservation program in the individual school.

Teachers and custodians are the first line of defense in an effective energy management program. Teachers can monitor room temperatures and make sure that windows and doors remain closed. Custodians can ensure the biggest savings of all, by making sure the furnace is set back at night, and equipment is operating properly.

Children can be enthusiastic supporters of energy conservation. They have fun and can learn while serving as energy monitor in the classroom.

Teachers play a pivotal role in generating that enthusiam and in teaching energy conservation techniques and concepts. In addition, children can take the message of energy conservation home to their parents.

Parents, too, can be involved in many ways from encouraging their children to learn about conservation, to working with principals and teachers, to practicing energy conservation in their homes and businesses.

CONCLUSION

None of what SEED programs has discovered is new or revolutionary. We have reaffirmed that turning down thermostats, sealing windows and doors, and turning off lights save energy and money. We have reaffirmed that energy conservation is most effective when people work together, utilizing those resources that are available to them. We are rediscovering resourcefulness—The Fourth R.

The film, The Fourth R, is available to school patrons, professional educators and others interested in the quality of our schools and in energy management.

The film may be borrowed without cost by writing:

Tenneco, Inc.
Public Affairs Department
P.O. Box 2511
Houston, Texas 77001

THE NEXT STEP

First, ask about energy management in your local district. Start with the Superintendent or the Business Manager. They will welcome your support.

At the state level, usually there are two agencies working with schools on energy. One is the state energy office, also known as the Governor's energy office or the department of natural resources. Second is the state department of education.

For assistance in finding the name and address of the appropriate state officials, your local school district's Superintendent or Business Manager once again is a good source of information. Also, the elected member of the state legislature from your district is another good source of information.

At the federal level, two offices will provide publications.

For general information and a guide to assistance available from federal and state agencies, contact:

Dr. Wilton E. Anderson, Director
Energy and Education Action Center
U.S. Office of Education
Room 514, Reporters Building
300-7th Street, S.W.
Washington, D.C. 20202

Professionals in education and energy management can obtain technical information by writing:

Education Programs Division
U.S. Department of Energy
MS 8G-031
Washington, D.C. 20585

27

Printed on 100% Recycled Text